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ABBREVIATIONS AND SYMBOLS

A - coefficient matrices in disaggregation process

A - lower bound for 3 parameter log normal distribution

A_k, A'_k - harmonic coefficients

AR - autoregressive model

AR(1) - lag one autoregressive model

AR1BP - AR(1) with Beard's procedure

AR1LT-2- AR(1) with 2 parameter log normal distribution

AR1LT-3- AR(1) with 3 parameter log normal distribution

AR1WHT - AR(1) with Kirby's modified W-H tranformation

ARMA - autoregressive moving average model

ARMA(1,1) - autoregressive moving average model (p=1, q=1)

ARMABP - ARMA(1,1) with Beard's procedure

ARMALT-2 - ARMA(1,1) with 2 parameter log normal distribution

ARMALT-3 - ARMA(1,1) with 3 parameter log normal distribution

ARMAWHT - ARMA(1,1) with Kirby's modified W-H tranformation

a - time distance between the random number (η) in a simple broken line process

$a_{i,j}$ - the i^{th} element of the residual series belonging to j^{th} month

B - coefficient matrices in disaggregation process

B - backward shift operator (i.e. $Bx_t = x_{t-1}$) ; also a parameter in ffGn or BL model

B_k, B'_k - harmonic coefficients

B^T - transpose of matrix B

BL - broken line

BL-H - BL with only high frequency term modified

BL-HL - BL with both the high and low frequency terms modified

b_j - least squares regression coefficient for estimating $(j+1)^{th}$ streamflow from j^{th} streamflow

C - coefficient matrix (= BB^T)

C_j - a sequence of random variables (zero mean and uncorrelation)

$C_L(k;H)$- covariance function of the low frequency term

C_v - coefficient of variation (= standard deviation/mean)

C_s - coefficient of skewness

FFGN-H - ffGn with only high frequency term modified

FFGN-HL- ffGn with only high and low frequency terms modified

FM - Methods of fragments using the annual flows from a Markov model

FMM - Modified method of fragments using the annual flows from a Markov model

FSC - First Spolia-Chander monthly model

ffn - fast fraction noise

ffGn - fast fraction Gaussian noise model

G(t) - gaussian random variable for the high frequency Markov term in ffGn model

$G_m(t)$ - gaussian random variable for the m^{th} low frequency Markov term in ffGn model

g - coefficient of skewness of the log values

g_j - coefficient of skewness of the j^{th} monthly flow

$g(C_j)$ - coefficient of skewness of C_j

$g(t_j)$ - coefficient of skewness of t_j of the j^{th} monthly flows

H - estimate of Hurst coefficient (h)

Hist. - Historical values

h - Hurst coefficient

i - sequence number of generated data ; also year

I - (1 x m) unit matrix

j - repetitive annual cycles of seasons usually 1 < j <12 ; month

K_i - normalized variate

k - lag ; random number uniformly distributed between(0,1) in BL model

L - number of low frequency Markov process of ffGn and number of simple BL processes

MA - moving average

N,n - sample size ; number of years of flow records

P_p - autocorrelation matrix order p

p - order of autoregressive process

Q - parameter in ffGn generator

Q_i - annual flow volume in year i

$Q_{i,j}$ - monthly flow for month j in year i

$Q'_{i,j}$ - adjusted monthly flow volume for month j and year i

Q_j - mean monthly flow for month j

q - order of moving average process

$q_{i,j}$ - standardized series of monthly flows

$q'_{i,j}$ - monthly flow series after the removal of harmonic components in mean and standard deviation (fitted series)

$q''_{i,j}$ - standardized fitted series

q_j - mean of fitted series for month j

R - multiple correlation coefficient ; adjusted range in chapter 5

R/S - rescaled range

r_j - serial correlation coefficient between streamflows in j^{th} and $(j+1)^{th}$ seasons

r_m - lag one autocorrelation coefficient of the m^{th} AR process

r_p - estimate of autocorrelation coefficient of lag p

S_j - standard deviation of the j^{th} monthly flows

SEN - Sen monthly model

SSC - Second Spolia-Chander monthly model

s - estimate of the standard deviation

s_j - standard deviation of fitted series for month j

S_{xx} - coefficient matrix in equation (6.3.4)

S_{xy} - coefficient matrix in equation (6.3.3) and (6.3.4)
S_{yx} - coefficient matrix in equation (6.3.4)
S_{yy} - coefficient in equation (6.3.4)
S_{zz} - coefficient matrix in equation (6.3.3)
T - sample size in ffGn generator
TF - Thomas-Fiering monthly model
TT - Two-Tier model using the annual flows from Markov model
TTM - Modified Two-Tier model using the annual flows from a Markov model
t - time
$t_{i,j}$ - random number having unit mean and zero variance
u_k - the k^{th} element of the residual series
V - matrix of random numbers
V_m - weight attached to the m^{th} simple BL process
W-H - Wilson Hilferty
$W_{i,j}$ - monthly flow for month j in year i having zero mean=$Q_{i,j}-\bar{\bar{Q}}_j$
W_m - weight attached to the m^{th} Markov process in ffGn generator
$\bar{\bar{X}}$ - estimate of mean annual flow
X - matrix of monthly flow volumes
$X_f(t;H)$- ffGn variate
$X_h(t)$ - high frequency Markov process (zero mean and unit variance)
$X_L(t;H)$- low frequency Markov term
$X_L(t;r_m)$-m^{th} low frequency Markov term
X_t - annual flow in year t
Y - annual flow volume
Z - matrix of residuals (zero mean and uncorrelated) = BV
Z_t - standardized flow in year t (zero mean and unit variance)
α_j - parameters which refect the relationships between successive months of the same year
β_j - parameters which refect the relationships between successive year for the same month

Φ - parameter of the first order autoregressive process

$\Phi(B)$ - autoregressive parameter

Φ_p - p^{th} autoregressive parameter

ϵ_t - random numbers with zero mean and unit variance

η_m - random numbers with zero mean and unit variance

ω - number of season (= 12 in this study)

μ - population mean ; average monthly mean = $1/12 \sum_{j=1}^{12} Q_j$

μ_j - hamonic component in mean for month j

ρ - lag one autocorrelation coefficient

ρ_h - lag one autocorrelation coefficient of the high frequency Markov process

ρ_j - lag one autocorrelation coefficient of j^{th} monthly flows

$\rho_j(1)$ - lag one serial correlation

$\rho_{j,j-1}(0)$ - lag zero cross - correlation coefficient

$\rho_{j,j-1}(1)$ - lag one cross - correlation coefficient

ρ_k - autocorrelation coefficient at lag k

γ - coefficient of skewness

γ_j - coefficient of skewness of j^{th} monthly flows

γ_k, γ_{ze} - autocovariance in ARMA generator

γ_x - coefficient of skewness of annual flow X_t

$\gamma(X_f)$ - coefficient of skewness of the ffn variante

$\gamma(X_h)$ - coefficient of skewness of the high frequency Markov term

$\gamma(\epsilon)$ - coefficient of skewness of the random number used in the high frequency Markov process

$\gamma(\epsilon_j)$ - coefficient of skewness of $\epsilon_{i,j}$ of j^{th} monthly flows

$\gamma(\epsilon_m)$ - coefficient of skewness of the random number used in the m^{th} low frequency Markov process

$\gamma(\xi)$ - coefficient of skewness of random variable ξ_t

$\gamma(v_k)$ - coefficient of skewness of the k^{th} random variable in V

θ - parameter of the first order moving average process

$\theta(B)$ - moving average operator

θ_q - q^{th} moving average parameter

σ - population standard deviation ; average monthly standard deviation = $1/12\ \Sigma\ S_j$

σ_e - standard deviation of random variable ϵ_t

σ_j - hamonic component in standard deviation for month j

σ_h^2 - variance of the high frequency Markov process

σ_j - standard deviation of the j^{th} monthly flow

σ_x - standard deviation of annual flow X_t

ξ_t - random numbers with zero mean and unit variance